

The Feeding of Infants

By ROWLAND HILL, M.D., M.R.C.P.LOND., F.R.C.S.EDIN.,

from the Belfast Hospital for Sick Children

A SOUND knowledge of the methods used in the correct feeding of infants can probably save the lives of more infants in the first twelve months of their existence than can any special knowledge of medicine or surgery. By far the most important cause of death in infants is some disorder of nutrition, and the importance of correct ideas regarding the subject of infant-feeding can therefore hardly be over-rated. The problem is not one solely of saving life during the perilous first year by avoiding such immediate dangers of improper feeding as acute indigestion, diarrhœal diseases, infantile atrophy, and rickets, but also of ensuring such a degree of general nutrition as will permit of healthy growth and the highest physical and mental development of which the individual organism is capable.

The infant requires the same food elements, namely, protein, fat, carbohydrate, salts, and those accessory food substances—the vitamins—as does the adult, but the forms and relative amounts of the food elements required by the infant differ from those required by the adult. One reason for this is the delicate structure of the organs of digestion in infancy and their inability to assimilate certain forms of food.

There can be no doubt in the minds of those with even a limited experience of infants that the ideal food for them is human milk. As one American pædiatrician, Brenneman, has put it : “The more fully one learns the fundamentals of the science, and the more nearly one masters the art of feeding babies artificially, the more one is impressed with the fact that to the young infant mother’s milk is a true specific, and that during this early period, at least, artificial feeding is a substitute that necessity alone imposes upon us.”

It is largely owing to the increase of breast-feeding since the war that the continuous decline of infantile mortality of recent years is due.

Every mother of a newly-born child should, in the absence of any of the extremely limited number of contra-indications, be considered capable of suckling her child, and it should be pointed out that there are many advantages to the mother herself in so doing, namely, (*a*) suckling aids in the proper involution of the uterus, (*b*) it is cheaper, (*c*) it is much less laborious than preparing artificial feeds, cleaning feeding-bottles, etc., (*d*) there is a lower sickness-rate amongst the breast-fed, consequently in the aggregate her child will require less attention.

Further, the advantages to the infant itself are of outstanding importance. It has a fivefold greater chance of survival during the first twelve months of its existence, and it is much less likely to contract rickets, scurvy, or spasmophilia; consequently in later life it will probably have a better physique and fewer bony deformities than the artificially-fed child.

The only two disadvantages of suckling fall upon the mother; it may interfere with her employment, and it will certainly interfere with the social duties of the modern "society woman."

There are only two absolute contra-indications to breast-feeding on the part of the mother, namely, active tuberculosis and malignant disease of the breast. Relative contra-indications are latent tuberculosis, puerperal insanity, mastitis, or labour complicated by severe hæmorrhage, eclampsia, or septicæmia.

In the infant, certain deformities, such as hare-lip or cleft palate, may interfere with sucking, whilst acute coryza, pulmonary atelectasis, congenital heart-disease, or the debility due to prematurity, may render sucking extremely difficult. In these cases the milk should be drawn from the breast by means of a pump and fed to the child by a dropper, or, better still, by introducing a No. 8 soft rubber catheter into the child's stomach and running in the meal through a funnel.

Certain ante-natal measures may assist subsequent lactation. A generous diet during pregnancy, containing milk, greenstuffs, and fruit, will supply a sufficiency of vitamins and salts, especially calcium, both for the mother and the foetus *in utero*. In the case of the mother's nipples being unduly retracted, measures of correction should be undertaken at least two or three months before the expected delivery. The breasts should be bathed daily with cold water, and the nipples should then be drawn out, either manually or by the suction of a breast pump.

The diet of the nursing mother should, with certain modifications, follow the same lines as those during pregnancy. Milk, porridge, green vegetables, salads, fruit, and meat should be allowed freely, but tea, coffee, spices, and other stimulants should be partaken of sparingly. Daily exercise in the open air, sufficient sleep, and freedom from worry and excitement, are essentials.

Frequency of Feeding.—The child should be put to the breast for the first time twelve hours after birth, and thereafter every six hours, both breasts being used, for twenty-four hours. For the next two days the intervals should be shortened, so that by the fourth day the infant is having three-hourly feeds. At the end of four to six weeks four-hourly feeds should be instituted, and shortly afterwards the infant should go for eight hours during the night without being fed.

Notwithstanding the measures just mentioned being carefully observed, certain difficulties may arise, e.g.—

(1) *Delayed Lactation.*—An ordinary healthy infant has sufficient reserves to go for forty-eight hours after birth without food. The secretion of milk in the mother's breast may be delayed until the fourth or fifth day after parturition. The most potent stimulus for the breast secretion is provided by the sucking infant. The infant should therefore be put to the breast at the intervals previously mentioned, even though there be yet no milk secretion, but immediately afterwards it should be given a little warmed water. If by the fourth day there is no appearance of milk in the breasts, or if the supply be deficient, a small artificial feed, consisting of two parts of cow's milk to one of boiled water, should be given. The vigorous

sucking of the child when put to the breast and the complete removal of any little secretion that may have formed is a powerful stimulus to further milk flow.

(2) *Insufficient Milk Secretion*.—This should be suspected if a breast-fed infant is restless and peevish immediately after suckling. Undernourished infants are inclined to vomit after feeding, owing to excessive swallowing of air whilst at the breast. A test-feed should be immediately carried out. The child is weighed in his clothes immediately before and immediately after his feed. The difference in the weights will show the amount of milk received. The weighings should continue for a whole twenty-four hours. The average daily amount of milk that an infant receives from the breast in the first few months of its life is between eighteen and twenty-five ounces. If it be found that the breast-milk is deficient, the following measures for increasing it should be taken :—

- (a) See that there is strong suction at the breasts at regular intervals.
- (b) Make sure that the breast is absolutely emptied after each feed; any residue left being expressed or withdrawn by a breast-pump.
- (c) Give the mother sweet malted drinks twice a day, e.g., Horlick's Malted Milk, Bourn-Vita, or Ovaltine.
- (d) See that the mother is having regular meals of ample quality and quantity thrice daily.
- (e) Promote optimism and freedom from worry on the part of the mother.
- (f) Have the breasts massaged twice daily for ten minutes, and douched with hot and cold water alternately.

Should these measures fail to increase the supply of milk, then complementary feeding should be resorted to. This consists in giving the child a small artificial feed immediately after each breast-feed. Two parts of cow's milk to one of water, with a level teaspoonful of sugar to each two ounces of the mixture, will be found a suitable meal. If the feed be made too sweet, the child will cease to take the breast.

I desire to emphasize that with care nearly every child can be given its natural food; breast-feeding for a month is better than none at all, and one eminent authority has laid down the dictum, "In all cases of doubt decide against weaning."

ARTIFICIAL FEEDING.

If human milk is not available, the most satisfactory substitute is fresh cow's milk. Some infants can digest and thrive on undiluted cow's milk, but the majority of infants require to have their milk suitably diluted with water, owing to the indigestibility of the fat and casein of cow's milk. The fat of cow's milk has a higher melting-point than the fat of human milk, and as received in the home contains a higher percentage of volatile fatty acids than human milk, and to this is due the tendency of cow's milk fats to "sour" in the stomach. Casein forms eighty per cent. of the protein in cow's milk, whilst only thirty per cent. of the protein of human milk is casein. Casein, when acted upon by acids and rennin,

produces large curds, and infants fed on undiluted cow's milk are liable to vomit these curds or to pass them undigested in their stools.

The Question of Boiling Milk.—Unless “certified milk” is available, it is on the whole much wiser to boil all milk that is to be given to an infant. The advantages of boiling are that it sterilizes the milk and destroys any tubercle bacilli that are present, and secondly, it modifies the casein, so that this forms much smaller curds in the child's stomach, thereby being more digestible. The disadvantages are that the vitamins, and especially the anti-scorbutic vitamin C, are liable to be destroyed, that there is a loss of a certain amount of the lactalbumen present, this being coagulable by boiling, and, lastly, that boiled milk is less palatable.

In practice, however, the vitamins can be replaced by giving a teaspoonful of orange-juice once daily, and half a drachm of cod-liver oil twice daily, and it is usually found that infants will take boiled milk quite readily.

Amount of Milk Required.—When an infant is fed on the breast it requires two and a half ounces of milk per pound of body-weight per day. Owing to the relatively greater amount of protein in cow's milk, it has been found by experience that the infant only requires, to satisfy his protein requirements, one and a half ounces of cow's milk per pound of body-weight per day. This amount of cow's milk will, however, be insufficient for his carbohydrate requirements. It will therefore be necessary to add sugar to the milk. It will be found that one level teaspoonful of brown sugar per pound of body-weight per day will satisfy most artificially-fed infants, and will enable them to maintain a steady gain in weight. Lastly, the passage of a large amount of urine of low specific gravity is one of the physiological requirements of the normal infant; it will, therefore, be necessary to add sufficient water to the cow's milk to provide for the infant receiving two and a half ounces of fluid per pound of body-weight per day, i.e., one ounce of water per pound per day will be required.

It is possible to set out these requirements graphically, thus—Body-weight in pounds \times ($1\frac{1}{2}$ oz. of milk + 1 oz. of water + 1 level teaspoonful of sugar) = Amount of food for twenty-four hours.

Cow's milk is definitely deficient in iron, and most infants fed on it ultimately show signs of anæmia. It is therefore advisable to administer iron and ammon. cit. in gr. $\frac{1}{2}$ doses in solution, thrice daily, to all infants so fed.

DIFFICULTIES IN ARTIFICIAL FEEDING.

Vomiting.—This may be due to the infant being unable to digest the fat in cow's milk. When such is the cause, the vomiting occurs a considerable time after feeding, and the infant brings up large curds. To overcome this difficulty, a low fat-content milk should be used. If a pint of milk be allowed to stand in a vessel for four hours, and then the lower twelve ounces be syphoned off, a milk containing only two per cent. of fat will be obtained; if the lower eight ounces be alone syphoned off, a milk containing only one per cent. of fat will be obtained.

If vomiting of considerable quantities occurs just after feeding (in the absence of pyloric stenosis), too much food has been given.

Constipation.—This is generally due to too small an amount of sugar in the food. Use may be made either of Lactose or Maltose (dextrin-maltose) instead of cane sugar, as they are definitely more laxative. Maltose is cheaper than Lactose, but it accentuates any tendency there may be to vomiting.

Diarrhœa.—This is most commonly due to infection of the bowel with organisms which ferment carbohydrate. When it arises, one should cut down the amount of sugar in the feeds and add additional protein in the form of casein, calcium caseinate, or protosol.

DRIED MILKS.

These are extremely useful for the artificial feeding of infants in the tropical countries where fresh milk is not available. They are also of use in this country if for any reason the usual daily supply of fresh milk has failed. Dried milks have this advantage: they are sterile and their composition does not vary. The destruction of vitamins by most processes of drying is not complete, and any danger of deficiency of these substances can be overcome by administering orange-juice and cod-liver oil. Examples of dried milks obtainable locally are Cow and Gate, Trufood, and Glaxo.

ACID MILKS.

The use of milk which has been modified by the addition of a dilute acid to it will be found valuable in some conditions. It has been found that premature infants and infants suffering from fermentative diarrhœa, acute gastro-enteritis, and other infections, tend to have hypochlorhydria. Owing to the buffer action of cow's milk (by this is meant the capacity of the curd of milk to absorb into itself acid or alkali without changing its reaction to litmus), the small amount of hydrochloric acid in these infants' stomachs is quickly mopped up or absorbed, leaving no free H.Cl. to raise the gastric contents to the optimum acidity for normal peptic digestion. The practice of adding dilute acids to cow's milk in order to fill the buffer before it reaches the infant's stomach has been found of the greatest advantage since it was first adopted some ten years ago. Many dilute acids have been used, e.g., lactic, hydrochloric, citric acid, pure or in the form of lemon-juice, and acetic acid in the form of vinegar. The one most commonly used in the British Isles is acid lactici dilut. (B.P.C.).

A pint of milk is boiled for two minutes and then rapidly cooled. When cold, the acid is added, drop by drop, stirring after the addition of each drop, until a fine curd just begins to form. In summer it will probably be found that the curd begins to appear after the addition of about forty-five drops; in winter, sixty drops may be needed. The milk is then set aside in a cool place. The amount necessary for a feed can be withdrawn at any time, the necessary water and sugar added, and after warming to blood-heat can be given to the infant.